

Pollination Activity

Introduction

Insects and other animals in search of a “free lunch”, sugary nectar and protein rich pollen from flowers, often perform a vital service for the plant. As the animal feeds, pollen is picked up from the male part of the flower (anthers) and transferred to the female part of the flower (stigma). This is called pollination. After pollination, fertilization must occur before a seed can develop. Fertilization occurs when a sperm from the pollen unites with an egg within the plant’s ovary. Many birds, bats, and insects act as pollinators. Some mammals and even reptiles are also pollinators.

Plants and pollinating animals have developed unique relationships and structures that allow them to successfully interact. For example, the long tongue (proboscis) of a butterfly and the tube-shaped flowers of butterfly bush (*Buddleia sp.*). In many cases both the animals and the plants benefit. However, some animals may steal nectar and pollen without pollinating the plant, and some plants will actually trap and kill their pollinators.

Without the services of pollinators many animals would not have the plants that they depend on for food, shelter or nesting. Humans too, are dependent on pollinators for food, medicines and clothing. It has been estimated that 1 out of every 3 bites of food come from plants solely or partially dependant on pollinators. Worldwide three-fourths of our crops depend on pollinators. We can even thank a pollinating fly for chocolate! Unfortunately, some pollinators are in danger because of habitat loss and pesticide use. To learn more about the plight of pollinators visit the Arizona-Sonora Desert Museum’s web site listed below.

Successful pollination depends on pollinators finding the right flowers at the right time. Pollinators locate appropriate flowers by visual, chemical and olfactory cues. Pollinators need to find flowers that are the right shape for their mouthparts and that offer the right amount and type of reward. Plants need pollinators to visit when their flowers are ready for pollination. Plants have developed many ways of directing insects to the appropriate flowers. One example is illustrated by this activity.

On an inflorescence (cluster of individual flowers) of *Lantana camara* one ring of flowers open per day. These first-day flowers are yellow, full of nectar, have mature pollen and have stigmas ready to receive pollen. By the second day, these flowers turn various shades of pink, orange and red, have less nectar and are no longer able to be pollinated but new yellow flowers open in the inflorescence’s center. After 3-12 days all of the flowers have opened. Some butterflies have learned to associate yellow flowers with the reward of nectar and/or pollen. This benefits both the butterflies and the *Lantana* plant. By visiting the yellow flowers, butterflies will be rewarded with more nectar. The plant benefits by directing the butterflies to the flowers that are ready for pollination. There are many variations on this theme in the plant kingdom.

Pollination Web sites:

<http://www.isis.ut.edu/~fanjun/text/poll.html>
<http://koning.ecsu.edu./plants-Human/pollenadapt.html>
<http://bluehen.ags.udel.edu/deces/beekeeping/pollination.htm>
<http://desertmuseum.org>

How to conduct the activity:

The Pollination Activity allows participants to become insect pollinators. There are five inflorescences, each with 17 individual flowers arranged with different combinations of yellow (high reward) flowers and red (low reward) flowers. Five inflorescences work well for 20-30 participants. The following types of inflorescence should be constructed: one all yellow flowers, one all red flowers, two with 10 outer-ring red flowers and 6 inner-rind yellow flowers, and one with 13 outer-ring red flowers and 3 inner ring yellow flowers. The sucking mouthparts (proboscis) of a butterfly are simulated best with non-noise-making party blowers. Double-sided sticky tape attached to the 'proboscis' tip allows players to pick up pollen as they visit flowers. Pollen (small craft pompoms) is placed in the cups so that yellow flowers are three-times as rewarding as the red flowers (2 pompoms per red cup and 6 pompoms per yellow cup).

Participants learn about the advantages and disadvantages of different feeding strategies while they race to gather the most pollen. Three to five minutes of 'foraging' time should be sufficient. All pollen must be on the proboscis to be counted. Participants can not use their hands except to hold their proboscis in their mouths. During the first round of the game all the participants can be "generalist" feeders, visiting any flower color they choose. In subsequent rounds, participants can be "specialist" feeders assigned to visit only one color flower. Red feeders will experience less competition as they visit the more abundant red flowers. Yellow feeders will get higher rewards from the less frequent yellow flowers but will experience more competition for those flowers.

Participants must collect a minimum of 10 pollen grains to survive. If a proboscis is broken it should not be replaced. Consider these participants as butterflies eaten or otherwise injured by predators and have them sit out. Only participants who collect a minimum of 15 grains per round should be considered successful. These individuals consumed enough nectar and/or pollen for their survival needs, as well as enough energy to successfully reproduce.

Materials:

***Makes one inflorescence.* Multiply by total number inflorescences needed to suit your group size. Five inflorescences work well for 20-30 participants.

- 17 red and/or yellow 8-oz plastic cups. The inside bottom of the cup must be flat, no inner ridge, or the pollen will not be removed efficiently.
- A three gallon bucket. Green is ideal, but any color will do.
- Plywood cut to fit the inside diameter of the bucket.
- Sand to fill bucket (leave a 2 inch space from the top).
- 17 lengths of flag wire (36 inches). Wire should be as thick as an average coat hanger and straight. Forestry flags are ideal but you'll have to remove the plastic flag with scissors. Flags may be found at hardware stores or can be ordered from Forestry Suppliers, Inc. (bundle of 100 for \$6.25) by calling 1-800-543-4203.
- Red and yellow poster board. One sheet will make 12 individual flowers.
- Hot glue gun and glue sticks.
- Tygon tubing (approximately 3/16 outside diameter and 1/16 inside diameter) 17 pieces measuring 3 inches each.
- Flower Pattern provided below.
- Small craft pompoms.
- Non-noise making party blowers (1 per student).
- Double-sided sticky carpet tape.

Assembly instructions:

1. Trace and cut flowers from poster board.
2. Make a center 'bud' out of poster board that is circular and about the same size as the other flowers.
3. Just under the cup-lip place a bead of hot glue around the entire cup and quickly insert cup into the flower opening until snug against the cup lip.
4. Hot-glue tygon tubing to the cup as illustrated. Be sure to plug the top of the tubing with hot-glue.
5. Cut plywood to fit bucket diameter.
6. Drill holes in lid as shown.
7. Fill bucket with sand and place lid on top.
8. Push the flag wire through holes in lid. The outside wires should be angled slightly away from the bucket and inner wires placed straight up and down.
9. Insert wires into the tygon tubing attached to the flowers. The top of the flowers should be closest to the center of the inflorescence.
10. Fill flowers with the matching-color pompoms.
11. Cut strips of sticky tape so that you can cover both surfaces of the party blower tips by about 1 inch by wrapping it over the tip. Remove backing from one side and apply to party blowers.